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Lubrication

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THIS ISSUE

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TRANSPARENT CUTTING OILS

PROGRESS marches ever onward and with good reason too. Our age-old way of life could not thrive without competition and competition would soon die if new or improved products did not continually find their way into Consumers hands.

Consider for a moment the Petroleum Industry, composed of some 34,000 individual companies, all operating on an intensive competitive basis. These companies collectively market more than 2,600 different types of Petroleum Products ranging from insecticides to asphalt shingles. In order for these companies to stay in business it is essential for each to spend a considerable amount of money on research exploring for new or improved products. The total amount is staggering; for example in 1950 about 100 million dollars was spent by the Petroleum Industry alone. Or to put it another way every hour of the day, day in and day out, the Oil Industry invests about $11,400 in research for new and better products.

Over recent years cutting fluids have received more than their share of the total efforts expended in research. This is due to a multiplicity of reasons but the prime factors include the stepped-up production rates of machine tools, improved and revolutionary changes in methods of manufacture, the growing use of carbide tools and the development of newer alloys for specialized applications.

Not only have cutting fluids been improved from every conceivable angle to their present high degree of performance but at least one development is outstanding. This is the development of transparent cutting oils.

NEED FOR TRANSPARENT CUTTING OILS

The primary advantage of transparent cutting oils is that the operator can observe the cutting tool and work piece through the film of fluid. This is highly important, particularly when extreme accuracies and fine finish are desired. Inspection of the parts produced can thus be more easily accomplished, since the finished work can be readily seen through the oil film without first washing the parts in a solution. This is particularly true in handling small parts from automatic screw machines. When using a transparent cutting oil the machine inspector can check the parts produced by this type of machine with a minimum of delay, and production continues at a high level. If on the other hand a dark or black cutting oil were to be employed, the machine inspector might have to stop the automatic until he removes the dark oil so that he can properly check the pieces. Should he not stop the machine parts might be produced that are not of size and thereby subject to rejection. Therefore the use of transparent cutting oils will increase production and reduce rejects.

One other advantage gained by using a transparent cutting oil is that the shop operating conditions are cleaner, therefore the skilled and other personnel are more satisfied, resulting in greater production, more accurate work, and less labor turnover. It has been reported by users of transparent cutting oils, that a clear oil has a psychological effect on the workers, and that they naturally become more careful in accomplishing their tasks.

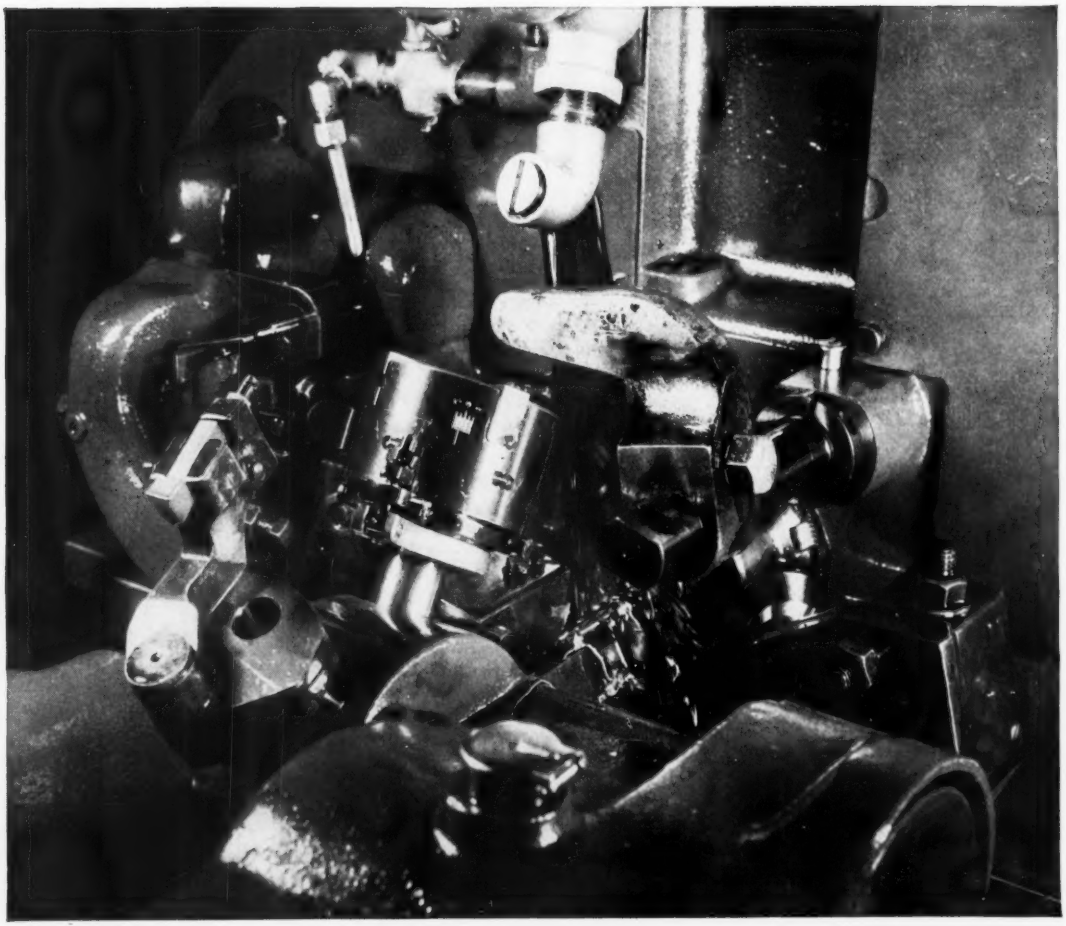

Figure 1—The use of a Transparent Cutting Oil in the operation of this type automatic screw machine increases tool life and production. Also reduces set-up time.

There is less handling of the parts between operations, and reworking to remove burrs is reduced. Strange as it may seem generally better shop housekeeping is practiced at no extra cost, when using a transparent oil. This also lowers the ultimate cost of production.

Cutting oils as used for many years have contained sulfur, chlorine and sometimes other additives in various forms or compounds for the purpose of reducing frictional heat developed during the machining of steel or its alloys. Unfortunately such additives when added to oil have a tendency to darken them. In fact highly compounded oils necessary in the most severe broaching, threading, tapping and similar operations are usually very dark or even black in color.

Heretofore, when it was necessary to use transparent cutting oils on the operations just mentioned, tool life would be reduced, surface finish impaired, production decreased, and tool costs increased because up until recently it was impossible to secure a transparent cutting oil possessing the characteristics and properties of the dark or black type cutting oils. As a result of extensive research, however, transparent cutting oils with sufficient compounding are now available to handle the great majority of machining operations taking place today. Recent developments in cutting fluids are described in more detail later in this article.

THE STORY OF SULFUR

From the late nineties when the importance of cutting fluids was first realized until the mid-twenties, conventional types of mineral oil or mineral-lard oil mixtures sufficed for most of the types of metal cutting which prevailed during this period. As the need for higher cutting speeds developed, and alloy steels became more common, an

oil of better cutting ability was required.

Long before the mid-twenties, the Petroleum Industry had anticipated the need for improved products and had made an extensive study of materials which could be added either to mineral oil, or mineral-lard oil blends to give the desired cutting oil characteristics. One of the first materials found was sulfur and this material is extensively used in cutting oils today.

In the very early days free sulfur was mixed in with mineral oil. Although this was a crude method it was effective on machine tools used at that time, because the free sulfur held in suspension helped to reduce friction. With such methods of addition however, but little benefit was derived.

During and after World War I a concerted effort was started to determine how more sulfur could be combined with mineral oil cutting fluids without excessive separation at the temperatures at which such fluids are normally stored. This effort has been multiplied in recent years and is continuing at an ever accelerating pace.

The reason for this is that modern machine tools could never have been developed to their present high degree of perfection without the availability of suitable cutting fluids to permit the attainment of high machining rates and the desired close tolerances and smooth surfaces on finished parts.

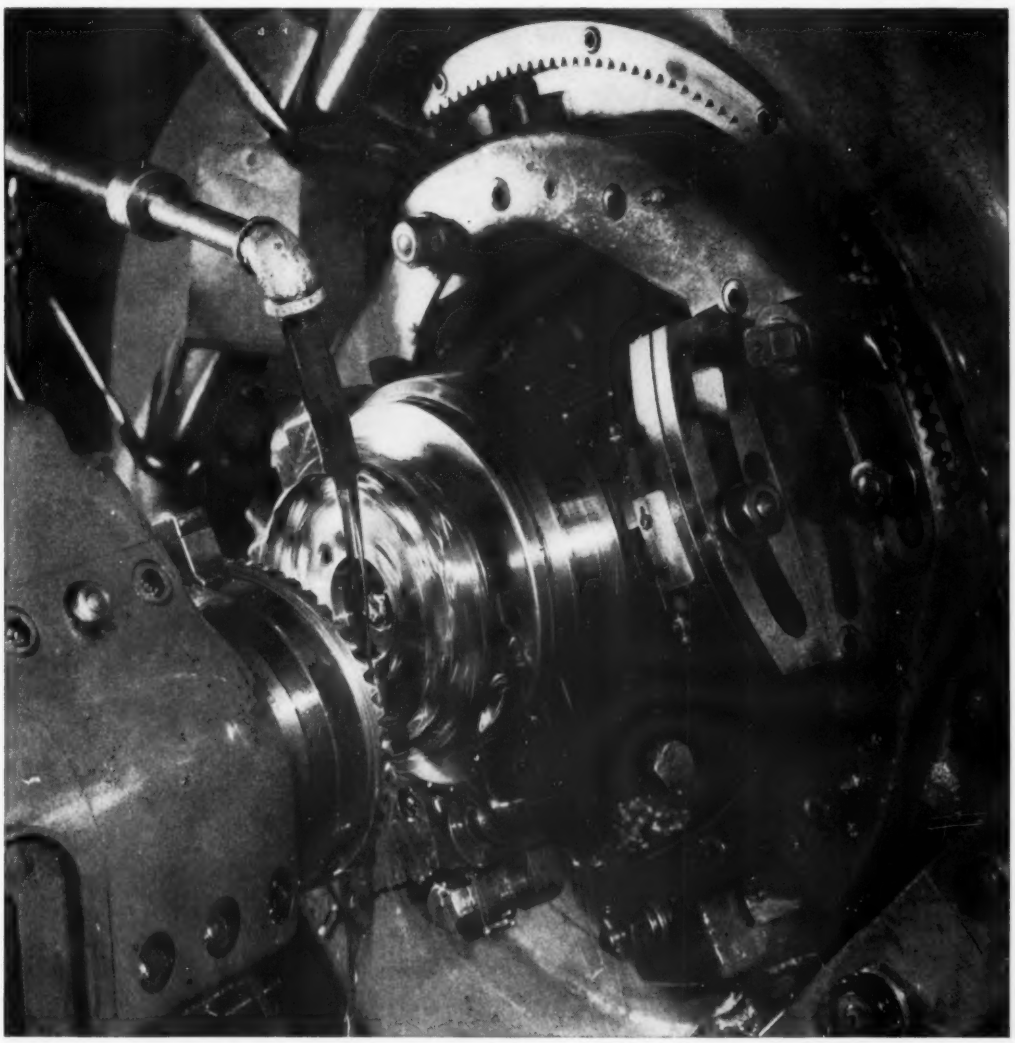

Figure 2—The ability of the operator to see the cutting tool during the actual cutting operation assists in the production of more accurate gear tooth form.

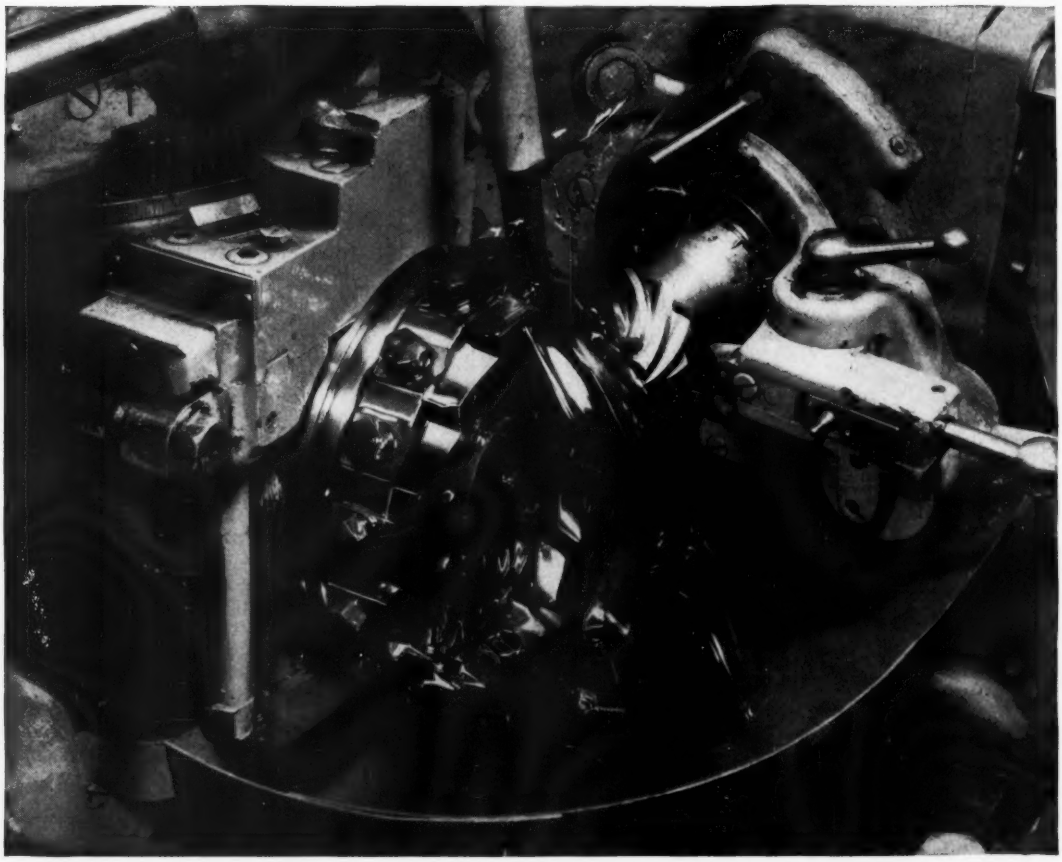

Figure 3—Another view showing the clarity of the oil film as it passes over the cutting tool and work.

Experience with sulfurizing mineral oils has indicated that when sulfur and mineral oils are in intimate contact there is a gradual change in behavior as temperatures are increased. At low temperatures it is mainly a question of the solubility of sulfur in oil. At more elevated temperatures and particularly when such temperatures are maintained it is a question of interaction as well as solution of sulfur in oil.

Additional studies have included investigation of air blowing to remove corrosive volatile by-products; studies of sulfurized oil bases blended with low viscosity straight mineral oils; suitability of sulfurized fatty oils versus sulfurized fatty oil blended with sulfurized or unsulfurized mineral oils and similar procedures.

Sulfur when combined with oils under certain conditions, which result in good cutting properties, also has a darkening effect on the final product. A great deal of work has been done to make such products both excellent cutting fluids and light in color. This investigation has encompassed two lines of attack. The first, described briefly above, concerned the methods of combining sulfur with oil and the second an investigation of many other materials which can be used. Current investigations indicate a combination of both methods may result in the ultimate in cutting fluids.

Surfurized cutting oils are not a cure-all for metal cutting difficulties. In fact, certain conditions and some metals prohibit their use. For example, "active type sulfurized oils," to be described later, are not suitable for machining brass or non-ferrous alloys due to the active nature of the sulfur which causes the surfaces of these metals to turn black. For such metals special "non corrosive" oils have been developed.

In most cutting operations today, with the exception of those requiring soluble oil emulsions, some form of sulfurized oil is used. Machining operations are affected by so many variables however, that no single product can be used in all types. For this reason each supplier must have available for use many types of fluids, some of which are described in ensuing paragraphs.

ACTIVE TYPE SULFURIZED CUTTING OILS

It has been well known for many years that acceptable cutting oils for the tougher operations are manufactured with sulfur content so high that the color of the resultant products is dark, in fact almost black. Not so well known is that during recent years much progress has been made toward maintaining transparency while increasing the sulfur content of cutting oils. Such products have been used extensively on milder cutting operations for several years.

As a result of continued research however, improved products have been made available which today are not only transparent but contain enough additives to enable them also to handle most of the "tough" machining operations for which dark oils were formerly required. Some of the more interesting properties of these newer transparent cutting oils are described below:

Transparency

Transparency of modern, high sulfur content cutting fluids can best be shown in illustrations such as Figures 2, and 3. Note how easily the oil can be seen through. With such oils parts can be observed without stopping the machine and the position of the tool as well as the finish can be observed readily.

Performance

With the newer transparent high sulfur content active cutting fluids, many machining operations are now being efficiently handled which were only possible to accomplish with dark or black cutting oils. Such transparent fluids are in the process today of fully replacing the darker type oils on many of the machining operations where the latter were considered indispensable only a few years ago. Today, transparent sulfurized mineral oils are handling many of the tougher broaching, threading, tapping and similar operations – coupling the high degree of performance of active type cutting fluids with the decided advantage of transparency.

For example, where a "black" highly sulfurized oil had formerly been used to thread bolts of 1010 steel and studs of 1015 steel, tests showed that a

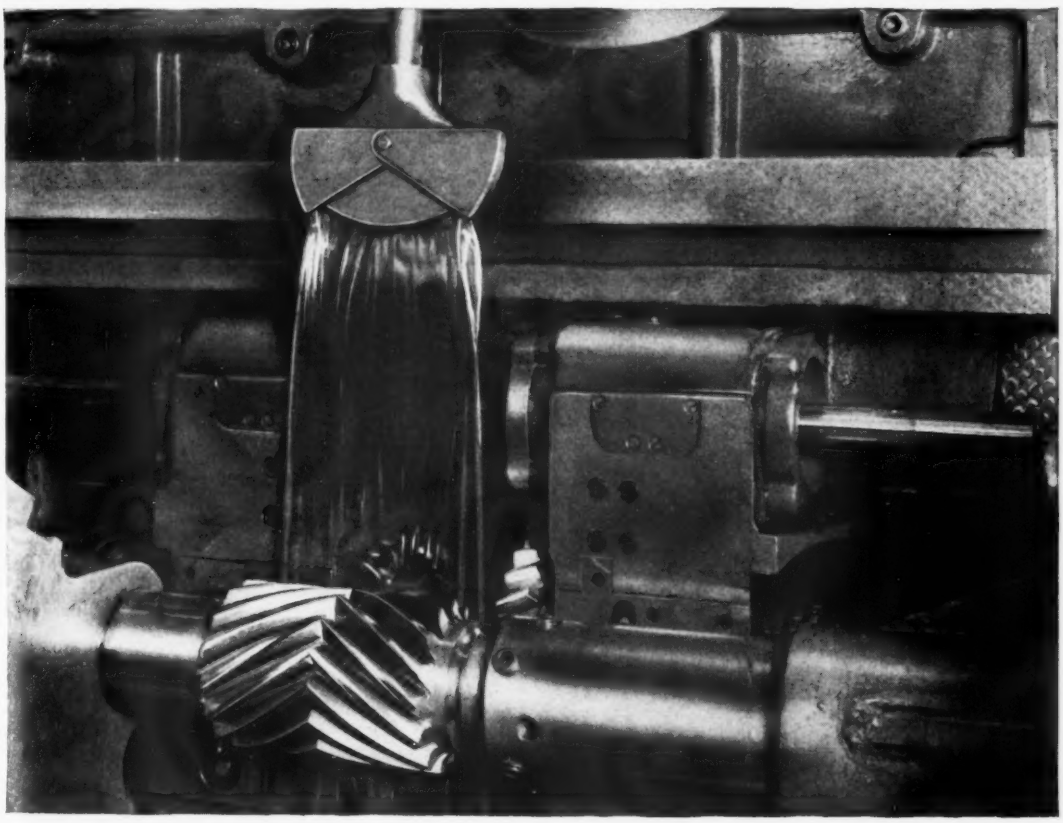

Figure 4—In this example of cutting a herringbone pinion, note how the work may be observed through a transparent cutting oil.

DERMATITIS

"Dermatitis" is an inflammation of the skin. It may have a single or a combination of causes but in this instance we are considering dermatitis that may arise from contact with cutting fluids.

Action of Cutting Oils on the Skin

Without adequate cleanliness and after continued exposure to cutting fluids and to dirt, the hair follicles and pores of the skin may become plugged resembling blackheads. The natural oils secreted by the skin and bacteria, found normally on the skin, accumulate under the blackheads and eventually develop into pustular eruptions or pimples; a so-called follicular dermatitis which is the most common type of oil dermatitis. Persons with hairy hands and arms are more susceptible to this type of involvement than are those with smooth hairless skins.

All petroleum oils have the property of defatting the skin which may cause drying with tendency to cracking, and fissuring. The open cracks and fissures in the skin invite infection. Workers with naturally oily skins will not be as subject to this type of dermatitis as will those with normally dry skins.

Normally a well-designed cutting oil contains additional ingredients other than petroleum oil, the purpose of which is to improve cutting performance. The presence of sulfur, chlorine, animal or vegetable fats and soaps is quite common. The exact nature and quantity of these additives should be controlled by the manufacturer, in order to avoid skin irritation.

After prolonged use, cutting fluids may contain many metal slivers which may become imbedded in or wound the skin, opening up avenues for infection. This is especially true when old, dirty towels and waste full of slivers are employed by the workman to dry or wipe the hands and arms.

Bacteria in Cutting Oils

Lubricating or cutting oils when refined by the manufacturer are free from bacteria. Bacteria are found, however, in air, soil, water, on one's skin, in fact almost everywhere. Bacteria, therefore, eventually find their way into cutting oil during use, which process, of course, is hastened when workers expectorate or throw refuse into the oil or the oil containers.

Cutting oils, as a whole, are not good culture media for bacteria. Bacteria will grow, however, in animal or vegetable oils but hardly at all in mineral oil, hence soluble oils, or insoluble oils having a high fatty oil content will have, after long use, a higher bacterial count than will insoluble cutting oils which have a relatively low fatty oil content. It is the insoluble type of cutting oil, however, which although containing no fatty oil gives rise to most of the dermatitis cases. This is further evidence that bacteria in the oil is not the primary cause of oil dermatitis. In fact, repeated laboratory investigations of samples of used cutting oils have revealed that the bacteria present in such samples were of non-pathogenic (harmless) type.

It is the germs normally present on one's skin which set up an infection under the oil blackheads as described above or which enter the skin and deeper tissues through breaks in the skin. Germs do not penetrate healthy skin, but if the skin is dry, chapped or fissured, or if it is abraded or punctured by the metallic particles in the cutting fluid, or in wiping rags and waste, then infection may follow.

Rancidity of fatty oils develops with time, heat and use. Additives are sometimes incorporated in the manufacture of cutting fluids to inhibit bacterial growth and thus prevent or delay the cutting oil from becoming rancid. Such additives will not prevent dermatitis, and in certain instances they in themselves may cause dermatitis among workers sensitive to such products or if used in concentrations strong enough to irritate the skin. Therefore, the users of cutting fluids should carefully investigate any antiseptics or disinfectants which they may wish to add since they may further complicate the dermatitis problem. Rancid oil should be filtered, neutralized and heat sterilized, and if this does not clean the oil sufficiently for further use, it should be discarded.

In prevention of dermatitis the user should put *emphasis on cleansing the worker* rather than the oil for, if the worker will keep himself clean, the chances of skin infection will be markedly reduced.

PREVENTION OF DERMATITIS

Cleanliness of Shop Personnel

Close attention to personal cleanliness and hygiene is the best means of avoiding skin trouble. By frequent and thorough cleansing of the hands and arms with soap, brush, and warm water, accumulations of oil and dirt in the skin pores can be prevented.

Where workmen observe the following precautions, excellent results in the prevention of dermatitis have been reported.

1. Before beginning work, change from street clothes to shop clothes and put on an oil impervious apron.
2. Before beginning work in the morning and after lunch, as well as at the close of work at noon and at night, wash with warm water and mild soap. Abrasive soaps should be avoided. If difficulty is experienced in removing oil and dirt from the arms and hands, wash with a granular soap which includes material such as cornmeal as a scrubber. Shower baths when quitting work should be mandatory when skin or body becomes oil-soaked.
3. Workmen should put on clean working clothes at least once a week, oftener if necessary.
4. Workers should be particularly careful to prevent the clothing from becoming soaked with the cutting fluid.
5. Splash guards attached to cutting machines and oilcloth armlets have been found quite effective in affording protection from flying chips and oil spray. Such guards, however, should be made of oil-proof material and should not be allowed to become dirty, loose, or ragged.
6. If the above measures do not suffice, workers with dry or sensitive skins should, after washing, apply a suitable oil resistant protective skin cream before starting work at the beginning of the shift and again when resuming work after lunch. The skin cream may also be applied after washing up at quitting time, if the skin is dry or cracked.
7. Spitting into drains or oil pans should be absolutely prohibited, as discharges from the mouth and throat always contain bacteria which will contaminate the oil. Cuspidors should be supplied to the machine operators, if necessary, and some provision made for cleaning them daily.
8. Workers should not use kerosine or other similar solvents to remove oil or grease from their hands since the solvents will further defat the skin and thus initiate dermatitis.
9. Clean wipe rags should be given to the worker every day. The rags should be laundered after use to remove metal slivers.

Certain individuals are much more susceptible to skin troubles than others, just as some people are afflicted by hay fever during certain seasons of the year. New workers having skin trouble of any kind should not be assigned to jobs where they come in routine contact with cutting oils.

Cleanliness of Machines

Each machine on which cutting fluids are used should be cleaned frequently, and all sediment and deposits of old lubricant removed.

Reconditioning of Products

Constant removal of the metallic particles is necessary to avoid injury to the skin. Ordinary filtration and centrifuging machines are not always capable of removing the minute metallic particles which may injure the skin. Where centrifuge or filter equipment are not available, heating will reduce the viscosity sufficiently to permit the metal to sink to the bottom of the tank or container. Replace oil regularly.

Some of the larger users of cutting oils heat the used cutting fluids for a short period of time to obtain resterilization. The temperature required to bring about complete sterilization is upwards to 245° Fahrenheit.

Treatment of Skin Infection

1. Send worker to the First Aid Room or to the plant physician upon the first sign of dermatitis.
2. Check to see if all preventive measures suggested are enforced.
3. If dermatitis is mild, he may return to his regular work; if it is severe, he should be temporarily transferred to other work where he will not come in contact with cutting fluids, or, if indicated, he should be given time off during the period of medical treatment.
4. After a severe dermatitis condition clears up, the worker may return to his regular job providing he observes the necessary preventive measures.
5. If the employe is allergic or sensitive to petroleum products or cutting fluids, he should be transferred to a department where he does not have such contacts. Such instances, however, will be relatively rare.

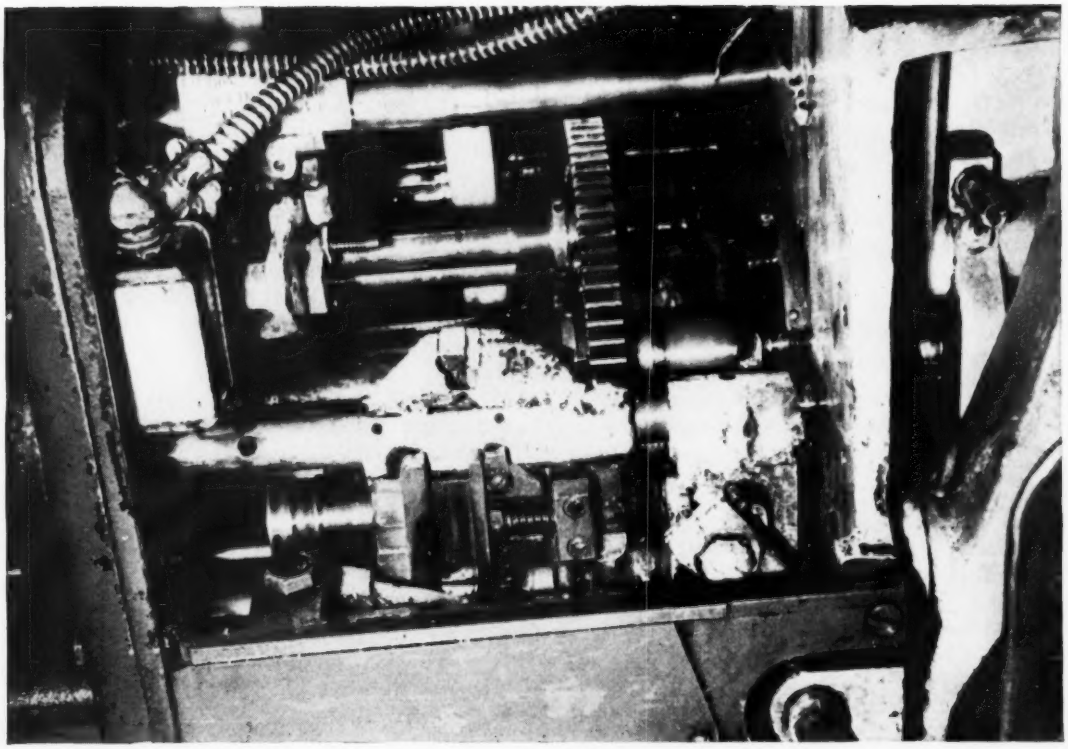

Figure 5—An example of where a transparent non-corrosive cutting oil has been used for over two and one-half years in a multiple spindle automatic as both a cutting oil as well as a lubricant. Note the clean appearance of the machine parts.

modern transparent oil could be used in this same application with no loss in die life.

In another application parts were machined from 3/8 inch round bars of 1015 steel at spindle speeds of 3000 RPM with a 0.003 inch feed on an automatic. Three oils were tested on a comparative basis, two "black" oils and one transparent oil, all of the active type and all highly sulfurized. The transparent oil was found to be equal in performance to one "black" oil and very slightly inferior to the second one.

In a third application push rods of SAE 4140 steel were being threaded at speeds of 60-63 feet per minute. With a high quality "black" oil, 700-750 push rods were threaded, whereas with a new transparent oil 500-550 push rods were threaded between chaser regrinds. The interesting part of this test was that with the best transparent oil available until recently, only 200-250 rods were threaded between chaser regrinds.

These three illustrations of actual fluid performances show forcibly what can be expected of new transparent cutting oils of the active type. They are superior by far to transparent oils of the type available only a short time ago, although as can be seen in some installations, they may not yet quite equal the best of the "black" oils in cutting performance. The significance of this is that the newer transparent oils can now be used in many, many applications where heretofore the dark sulfurized oils had to be used, and improved efficiency and better products became a possibility.

Corrosive Characteristics

Cutting oils designed for "tough" machining operations of necessity contain sulfur in active form. For this reason such oils will corrode copper at room temperature, and unless they are not properly treated or compounded they will also corrode steel or its alloys.

Active sulfur type cutting oils are not generally used for the machining of copper or its alloys, because such materials may become discolored and require a subsequent cleaning operation. These materials are in most cases machined with a non-corrosive type cutting oil.

General Properties

In other respects transparent cutting oils of the active type are outstanding. They dissipate heat

rapidly, provide more efficient operation, carry-off is minimized and they readily separate from chips and contaminants.

Summing up, such oils more nearly approach the ultimate in cutting fluids than any type developed to date. With resultant increased tool life, better finish, ease of inspecting parts, ready observance of the tool and improvement in cleanliness of both machine and operators, the use of such products can make a sizeable reduction in the overall cost of the manufactured pieces.

Non-Corrosive Type Cutting Oils

Research in the field of sulfurized cutting oils indicated there was undoubtedly some relation between the corrosive tendency of such oils and the way the sulfur is dispersed or combined in the oil.

As a result of additional research, however, sulfurized cutting oils are now available which are non-corrosive, as shown in Figure 7, at reasonable temperatures to copper and its alloys. Such oils will handle all types of machining operations on milder types of steel and on non-ferrous metals. They do not however, possess properties which would make them adaptable to "tough" jobs.

Multi-Purpose Uses

Some non-corrosive sulfurized cutting oils have such exceptional properties that their use has extended beyond that of a cutting fluid.

Well known examples include their use in automatic screw machines. In these machines there often exists a condition wherein the cutting fluid is mixed with the oil from the machine lubricating system or the hydraulic system due to leakage. This dilution is obviously undesirable if it reduces the effect of the compounding agents in the cutting oil thereby causing progressively poorer cutting performance and tool life as dilution increases.

This problem of dilution can be handled by the use of one product as both a cutting fluid and machine oil and also as the hydraulic medium if the

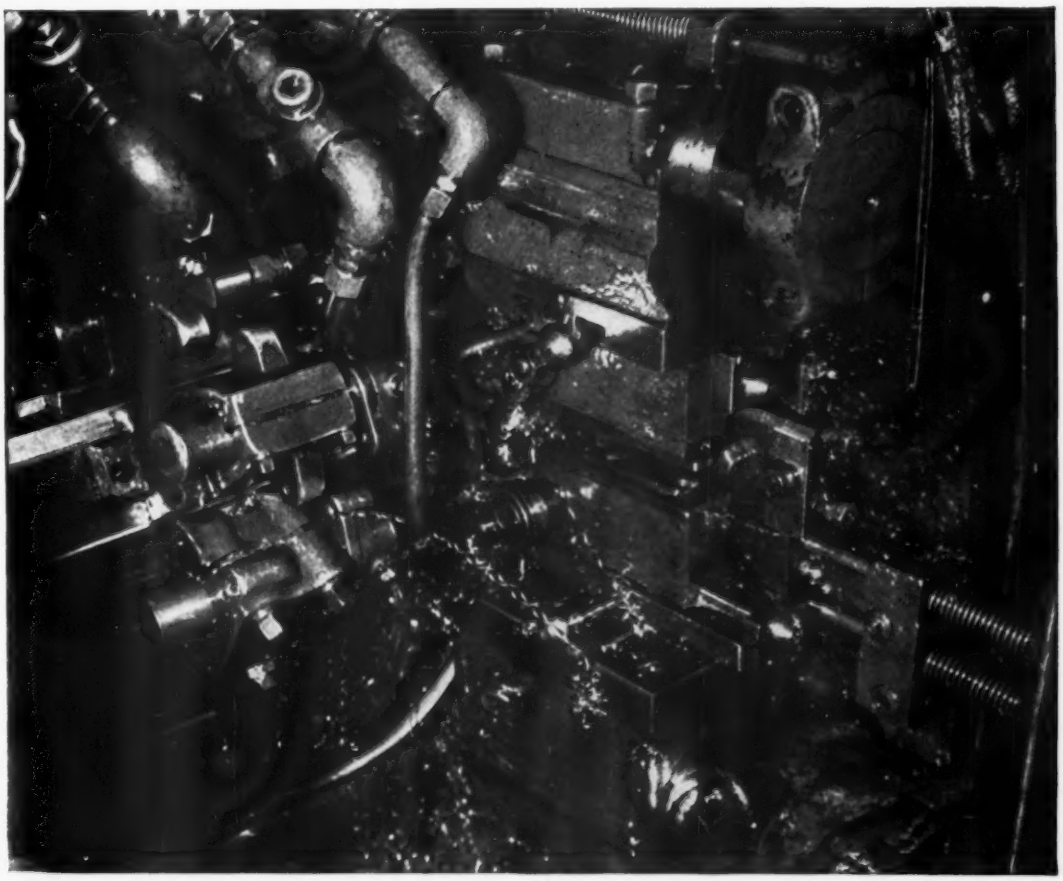

Figure 6—Cutting side of the automatic shown in Figure 5. Note the transparency of the oil.

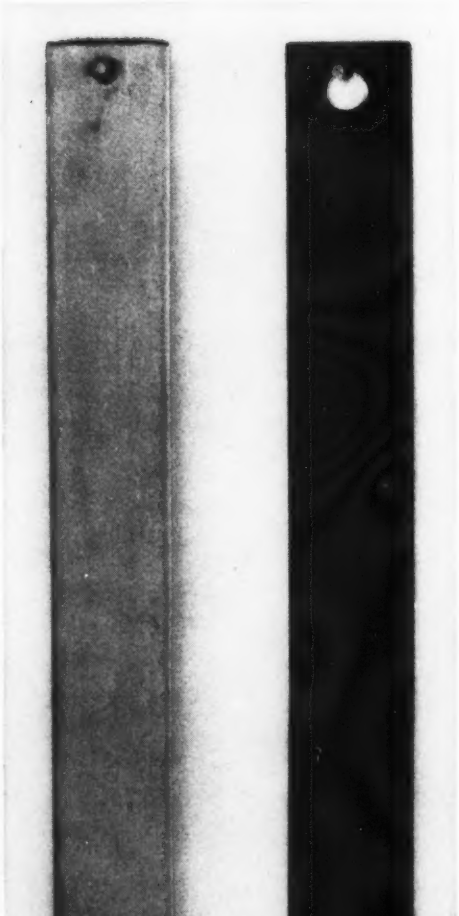

Figure 7—Showing two copper strips both being highly polished. One was immersed in a non-corrosive cutting fluid, the other in an active sulfur cutting oil at room temperature for one hour. The effect of sulfur reaction with the latter can be seen on the blackened strip.

machine is so equipped. From such uses are the names "Dual" or "Tri-Purpose" oils derived. Specifically, in such operations certain non-corrosive sulfurized mineral oils can be used with entire satisfaction for each machine function.

Even when the nature of the work being processed would require the use of an active type sulfurized cutting oil, a non-corrosive sulfurized cutting oil can be advantageously recommended for both the machine lubricant and hydraulic system in automatics where leakage is a problem. The reason for this is that dilution of the cutting fluid with the non-corrosive sulfurized cutting oil used as either a lubricant or hydraulic fluid does not have nearly as harmful an effect as that resulting from dilution with a mineral lubricating or hydraulic oil. Therefore, the cutting fluid can be used for a much longer time, efficiency is increased and tool life is extended.

The foregoing use of "Dual" or "Tri-Purpose" oils has been singularly successful in both single and multiple spindle automatic machines. In using such products, however, it can not be stressed too strongly that only new oil should be used in the machine lubricant reservoir and hydraulic system. Reclaimed oil will undoubtedly contain finely divided particles of metal and should not be used for lubrication of any parts of the machine or hydraulic system.

GRINDING OILS

During recent years there has been a steady growth in the use of oils for grinding in preference to soluble oil emulsions. Although emulsions afford maximum cooling rates there are certain advantages in the use of oil, one being transparency.

Grinding oils are particularly advantageous in form and thread grinding because rate of wear and breakdown of the wheel are minimized. As a result of this, oils are gaining in favor over emulsions for still other types of grinding operations.

Reduction in the rate of the wheel wear is one of the most important advantages in using oils rather than emulsions for grinding fluids. Because of this factor it is possible to obtain longer wheel life and therefore to decrease the cost of dressing the wheel and to increase the efficiency of the grinder. The use of oil also permits a faster grinding rate, in some cases three or four times that possible with emulsions. The surface finish and the accuracy obtainable with oils are much better than can be obtained with emulsions. Another advantage of oil is the reduced tendency towards rusting which is a possibility when emulsions are used. All of these factors combine to reduce the unit cost of the finished part.

On the basis of the foregoing advantages it is not surprising that oils are gaining in favor over emulsions for grinding work. Oils however have two disadvantages which may prevent their adoption for all forms of grinding, at least under present conditions of operations. Oils can not dissipate heat as rapidly as soluble oil emulsions and hence for certain types of grinding operations where an excessive amount of heat is generated the use of soluble oil emulsions may be necessary. A second factor is mist which may be formed with oil. This

constitutes a fire hazard which may be alleviated by specially designed equipment.

TRANSPARENT SOLUBLE OIL

The great majority of soluble oil emulsions on the market today are milky in appearance and are not transparent. There are a few special applications however where transparency of the emulsion becomes a definite advantage. Such locations include primarily certain types of surface grinding where it is desirable to observe the exact progress being made. For example in the grinding of parts having a shoulder it is usually necessary that the wheel be brought up to the shoulder but no closer.

Transparent soluble oils are normally "synthetic detergents". The term "synthetic" as commonly applied to such soluble oils means that these products do not contain any petroleum type oils. These soluble oils are usually expensive, being two to four times higher than mineral oil type soluble oils.

Like all detergents, transparent soluble oils have excellent cleansing or washing ability. They have the ability to wash away lubricating oils on moving surfaces thereby causing sticking if allowed to come in contact with such surfaces. For this reason the use of transparent soluble oils is normally confined to certain types of grinding operations or to the use on other machine tools where there is no danger of the soluble oil washing out the lubricating oil from moving surfaces.

In general synthetic soluble oils are more sensitive to water hardness than the ordinary soluble oil. In fact with some of the former it is necessary to use water conditioners in order to assure ease of mixing with some waters, to obtain stable emulsions and to secure protection of the parts against rusting. Like all soluble oils, depending upon the type used, the rust protective ability of transparent emulsions may range from poor to good.

There is no doubt that the use of transparent soluble oils has a place in the overall machining operations encountered today. Due to the limitations outlined above however, the use of such products is generally confined to specialized applications where transparency is of major importance. These applications represent a very minor proportion of the total soluble oil emulsion applications.

OILS FOR MACHINING ALUMINUM AND MAGNESIUM

In the great majority of cases all machining operations, including grinding, of aluminum and magnesium are performed with the use of a specially compounded light mineral oil, replacing the kerosine-lard oil mixtures formerly employed as a cutting fluid.

The base oil used in most instances in preparing an aluminum or magnesium cutting fluid is paraffinic in nature, well refined and selected so that the resultant product viscosity will be in the vicinity of 40 to 60 seconds Saybolt Universal at 100° F. Such oils by nature are light colored and are transparent on the work piece. Transparency as such therefore is no problem in connection with fluids used in the machining of aluminum or magnesium.

APPLICATION OF TRANSPARENT CUTTING FLUIDS

The proper selection of a transparent cutting fluid, like any other cutting fluid, is a highly complex procedure and should be made by competent personnel.

Many many factors, almost too numerous to mention, govern proper selection. For example, consider the use of soluble oils and surface finish for a moment. In one instance a soluble oil emulsified with water in a given ratio was being used with entire success until redesign of parts being machined necessitated a better finish. Personnel in charge did not realize that with the specific soluble oil in use a simple change in water to oil ratio would give the desired finish, so they embarked on a time-consuming and expensive testing pro-

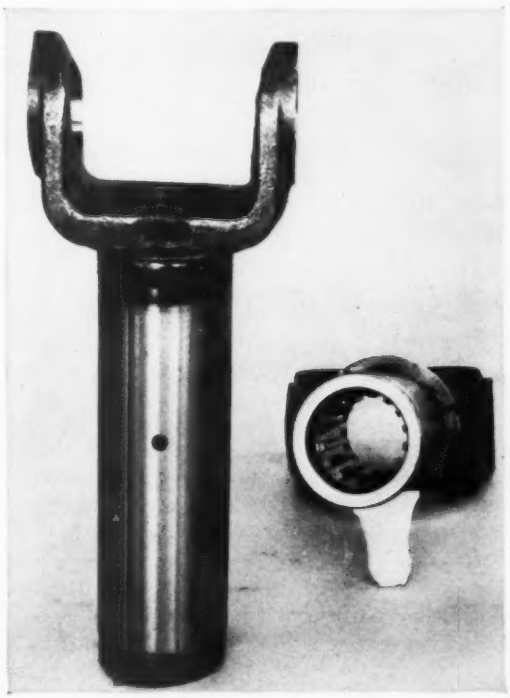

Figure 8—Internal broaching of splines which was formerly done with heavy duty type dark cutting oil is now being done with transparent cutting fluid.

gram of various products. A competent cutting and grinding fluid engineer could have solved their problem with little or no loss in time and production.

In other instances a simple change in speed of cutting or in the tool set-up can account for astonishing savings. A study of the requirements of a specific application may reveal that by using a different cutting fluid production may be stepped up, tool life increased enormously, down time reduced, surface finish improved and overall maximum economies realized.

There are several ways of obtaining such economies in any given plant or production shop.

Responsibility for Selection

In any plant or shop it is essential the responsibility for the proper selection of cutting fluids be given to one individual or a group of individuals depending upon the number of machines involved.

Some plants permit department foremen or even individual machine operators to use proprietary brand name products preferred by them. Unfortunately this situation leads to unnecessarily high inventories, excellent possibility of misapplications and crowded storage facilities.

Such a situation can be overcome by simple planning and a detailed survey of machine requirements. Surveys can be made by the person or committee placed in charge of cutting fluids selection or a cutting and grinding fluid engineer from the fluid supplier would be more than glad to make such a survey.

The importance of having responsible parties in charge of the selection of cutting fluids and their application cannot be over-emphasized.

Available Engineering Service

As mentioned before the proper application of cutting fluids is influenced by many factors, and is so complex that most fluid suppliers have available a corps of cutting and grinding fluid engineers who spend their entire time working with cutting fluids and their application. These persons are highly trained specialists and know how to recommend the most suitable fluid and its usage so that unit costs are held at a minimum.

Experience has shown that two factors are involved in the use of cutting fluids. The first concerns the proper selection and this is highly important. The second is how the fluid is used. The importance of the latter cannot be over-emphasized for on almost any machine tool it is relatively easy by improper tool set-up to make an inferior fluid appear to out perform a superior product. Only if a carefully selected product is used and the tool set-up is correct can production be stepped up to maximum output.

DERMATITIS

Dermatitis as such is not within the scope of this article on transparent cutting fluids. On the other hand, with any type of cutting fluid dermatitis can occur if certain precautionary measures are neglected. Too often the importance of such simple precautionary measures as personal cleanliness and good housekeeping is overlooked resulting in dermatitis complaints from operating personnel. For this reason a discussion on dermatitis may be found on pages 78 and 79.

CONCLUSION

Improvements in machine design, in metals to be machined and in cutting fluids to be used are so dependent upon one another that a radical advance in one field cannot be made without corresponding developments in one or both of the others.

During the last decade or two tremendous improvements have been made in machine tools. Power has been doubled, speeds have increased, automatic controls are being utilized to the fullest and improvement in lubricating methods have been outstanding. In the field of metals the development of jet engines and similar machines of war and peace have challenged both the machine designer and the cutting and grinding fluid supplier.

Keeping step with such developments has been the corresponding improvements in cutting fluids. In the last ten years there has been at least some improvement, and in many instances pronounced improvements in almost every cutting fluid available. During this same period many completely new products have been developed to meet specialized conditions.

One example of such improvements is the development of transparent active type sulfurized cutting fluids. These fluids open the way to previously unrealized potential savings. Work in progress can be observed or measured readily. Parts are easily inspected and cleaned if necessary. And as an extra dividend there is the improvement in morale of the operators. They prefer the transparent fluids because their machines, their clothes and their hands stay cleaner. Such improvements in appearance and operator satisfaction cannot but help increase the efficiency level in any plant.

Petroleum Research Laboratories are currently spending a great deal of money and effort in making further improvements so that unit costs of parts being machined can be reduced even more than has been possible in the past, and production rates increased to meet new demands. Such research cannot help but benefit the user.

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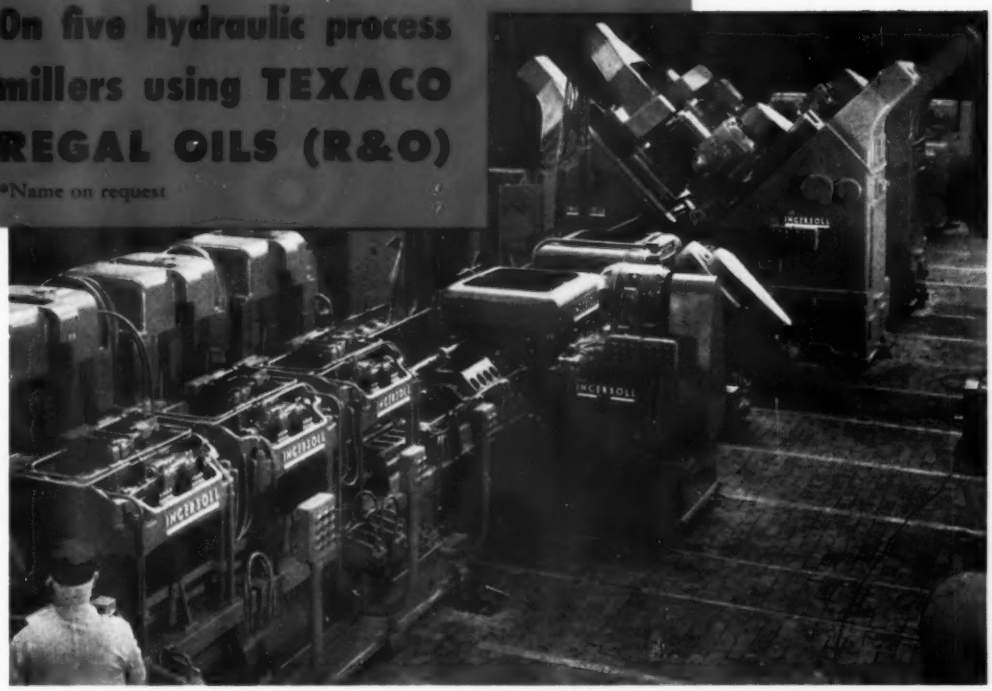

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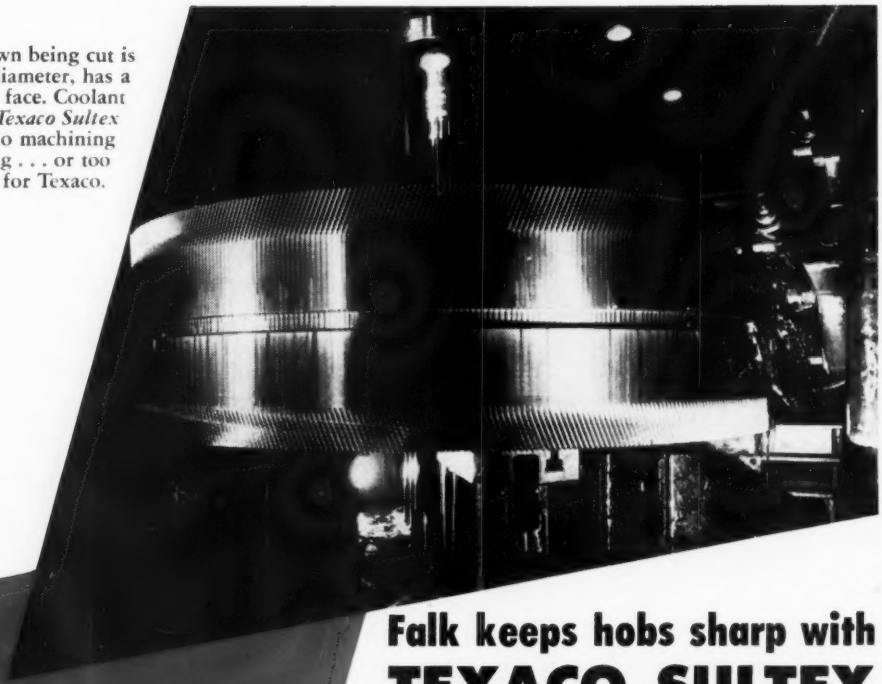

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